



## **Simple spatial distribution models for vector density in a field**

Bloodsucking creatures from dusk to dawn

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# Simple spatial distribution models for vector density in a field

Bloodsucking creatures from dusk to dawn

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# Introduction

Bluetongue virus in Northern Europe

- Infects ruminants
- Vector-borne
- Females of:

*Culicoides obsoletus* group

*Culicoides pulicaris* group



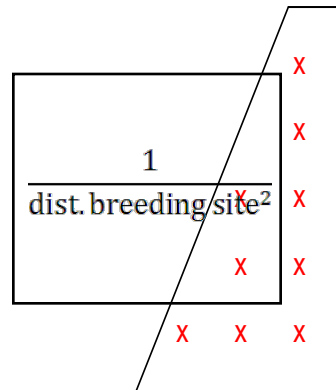
# Objectives

- Model vector dispersal → spread of virus
- First step: Where are the vectors?
  - (Spatial) factors for vector density?
- Spatial prediction model
- Linear Mixed Model
- Density measure: Light trap

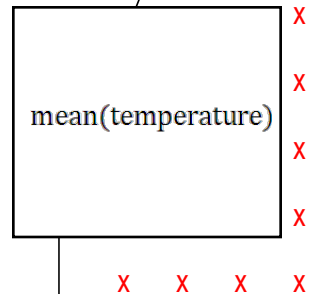
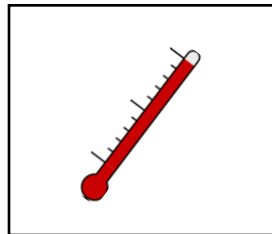
# Study design

- 50 light traps – 50 m grid

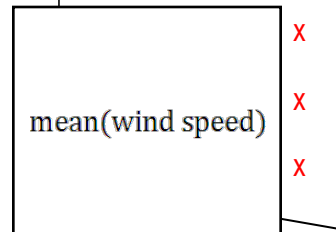
- Dist. to Breeding sites



- Temperature



- Wind speed



# Study design

- Smell of host animals



$$\frac{\text{wind speed} * \text{wind effect} * 1}{1 + \text{dist. sheep}^2}$$

- Windbreaks



$$\frac{\text{wind effect} * 1}{1 + \text{dist. windbreak}}$$

- Interactions:

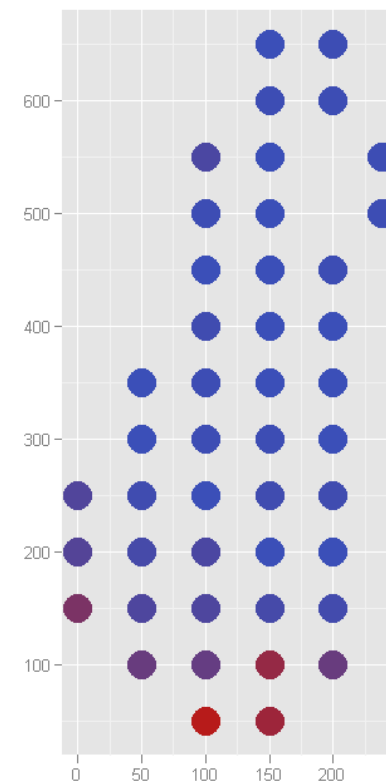
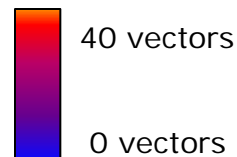
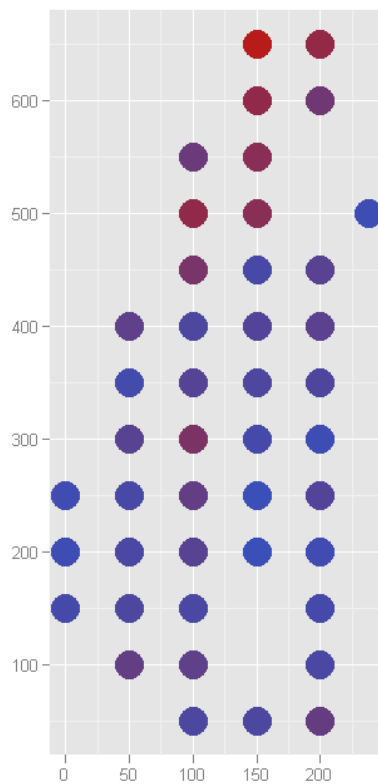
Host animals \* Windbreaks  
 Wind speed \* Windbreaks,  
 Temperature<sup>2</sup>



# Dataset

Analysis of 8 days: 5180 female vectors

Day	A	B	C	D	E	F	G	H	Total
<i>C. obsoletus</i>	316	259	612	2	93	95	29	253	1659
<i>C. pulicaris</i>	1524	335	952	4	190	223	33	260	3521



# Dataset

- Temperature: 12 – 20°C
- Wind speeds: 0.2 – 3.3 m/s

## Procedures

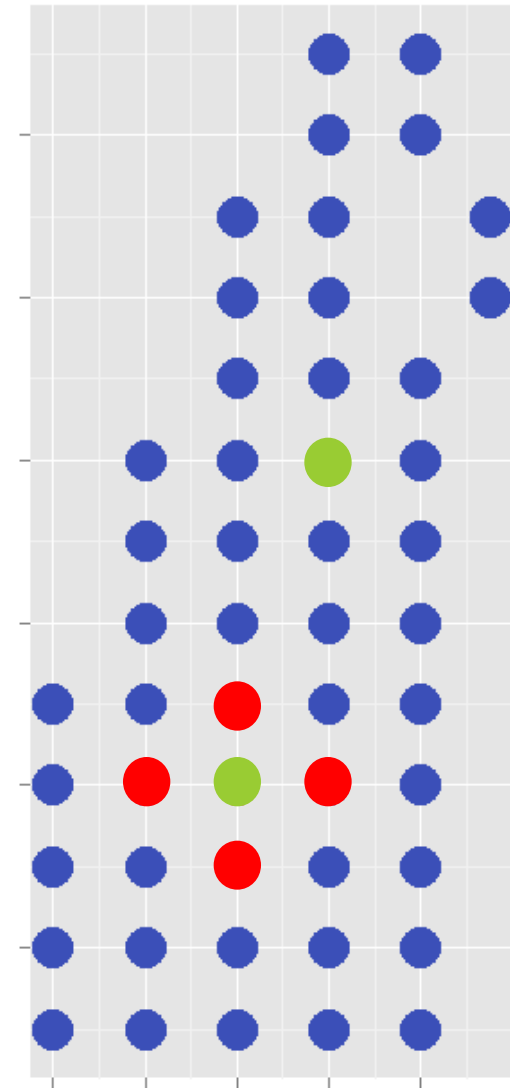
- Normalize data
- Random effect → Mixed Effects Model
- Observations not independent...



# Data analysis

## Spatial correlation

- *All information on the surroundings for a trap is contained within the neighbors*
- $X \perp\!\!\!\perp Y \mid \text{Neighbors}$
- $\text{Corr}(X, \text{Neighbor}) = \rho$



# Final model

- *C. pulicaris* estimates

Wind speed: -0.56

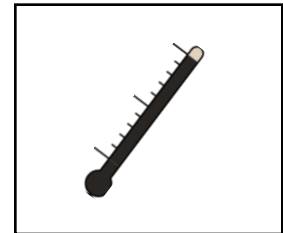
Windbreaks: 2.34

Wind speed : Windbreaks : -1.19

(adjusted for spatial correlation)

- *Spatial correlation coefficient,  $\rho = 0.26^{***}$*

N.S.



N.S.



N.S.



# Final model

- *C. obsoletus* estimates

Wind speed: -0.59

N.S.

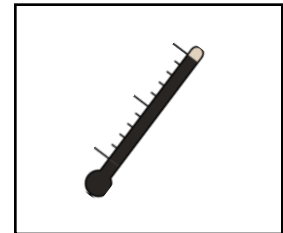
(adjusted for spatial correlation)

N.S.

- Spatial correlation coefficient,  $\rho = 0.33^{***}$

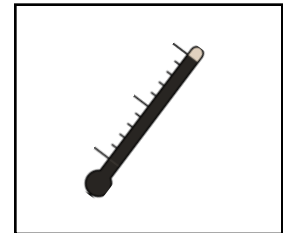
N.S.

N.S



# Conclusions

- Temperature not significant
- Breeding sites not significant
- Host animals not significant
- Windbreaks significant for *C. pulicaris*
- Wind speed significant



# What's next?

- More covariates

Precipitation?



- More days
- Broader scale



**Thank you for your attention**  
**Comments are welcome**

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